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CORDULEGASTER TALARIA, N. SP. (ODONATA: CORDULEGASTRIDAE) FROM WEST-CENTRAL ARKANSAS

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Abstract.—A new species of Cordulegastridae, ***Cordulegaster talaria,*** is described from specimens collected in the Ouachita Mountains in western Arkansas. The new species is related to *C. bilineata* (Carle) and *C. diastatops* (Selys). The ventral teeth of the male cerci are separated by a larger gap in *C. talaria* (0.77–0.89 mm) than in the other species (0.52–0.73 mm). The anterolateral yellow mark on abdominal segment 4 is elongate and extends to the anterior margin whereas in *C. diastatops* it usually does not reach the anterior margin and in *C. bilineata* it is abbreviated to absent.

Key Words: Odonata, Cordulegastridae, new species, Arkansas

While searching for Odonata in the Ouachita Mountains of western Arkansas in 1990, I collected a relatively small black and yellow cordulegastrid that I could not positively identify in the field. The color pattern was reminiscent of *C. diastatops* (Selys), a species that ranges from northeastern Canada south to Virginia and west to Illinois and Wisconsin. Subsequent examination with a microscope and comparisons with known species convinced me that the specimens represented an undescribed species. The discovery was surprising as this family of large dragonflies is well studied.

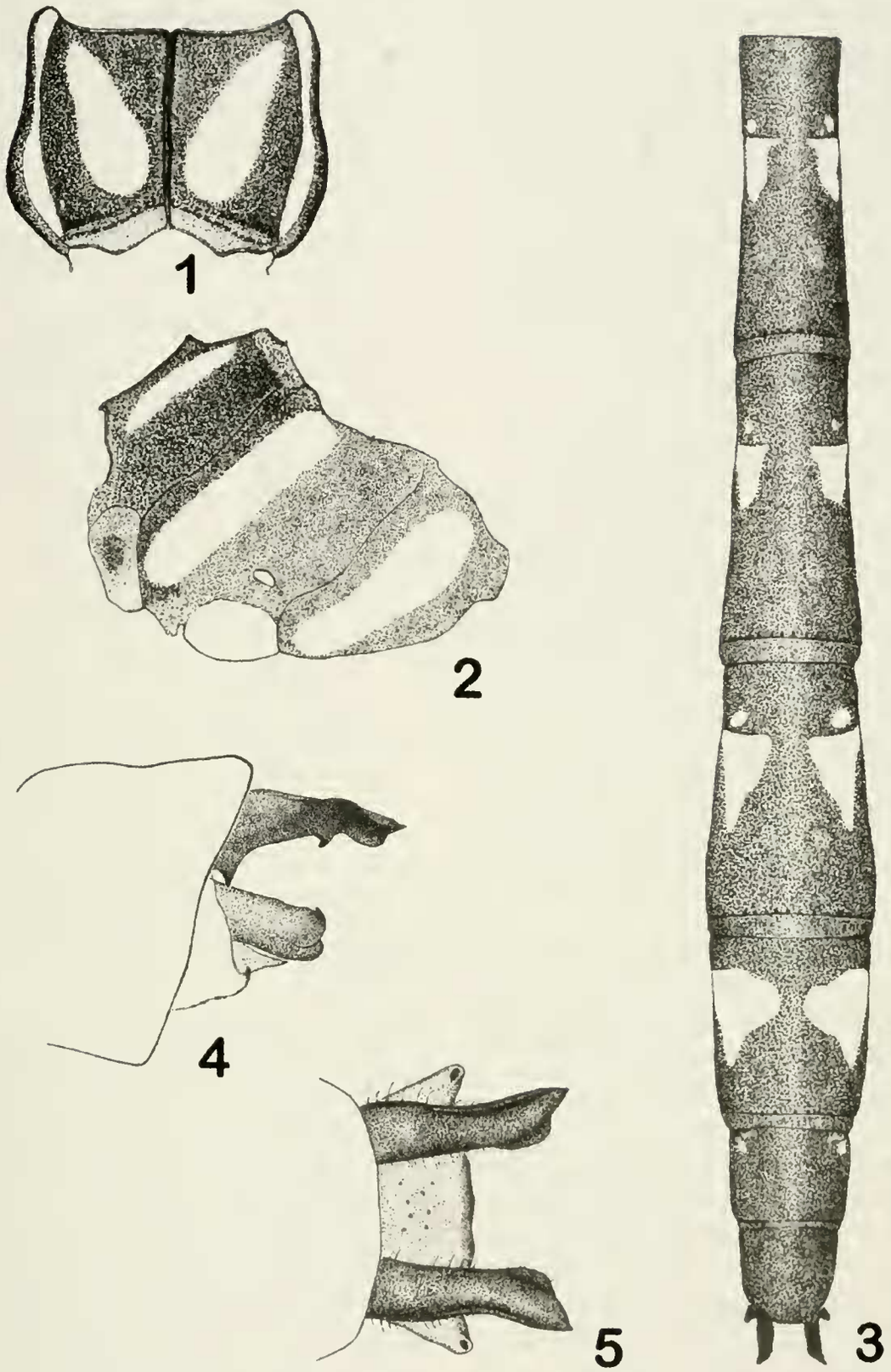
Lohmann (1992) resurrected *Zoraena* Kirby 1890 for *C. bilineata* (Carle) and *C. diastatops* and erected a new genus, *Archegaster,* for *C. sayi* Selys. He also erected a new subfamily, Zoraeninae, for this species group. Prior to Lohmann, Carle (1983), in describing *C. bilineata,* had resurrected the generic name *Zoraena* for these species (*bilineata, diastatops* and *sayi*). Many of the distinctions used by the above authors to split *Cordulegaster* into various genera appear to be characters of degree (e.g., mid-dorsal carinae of abdomen slightly more developed) or are intermediate character states. Needham et al. (2000) opted for the more traditional, conservative usage and placed all North American species in *Cordulegaster,* with which I concur. The four species, *bilineata, diastatops, sayi* and *talaria,* are obviously closely related and for convenience can be referred to as the *diastatops* group.

Specimens of the new species I collected were dried in acetone and stored in cellophane envelopes. Wing vein terminology and other morphological terms follow Needham et al. (2000). Illustrations were made with aid of a camera lucida and measurements were made using an ocular micrometer on a Wild M-8 Stereomicroscope.

Cordulegaster talaria Tennessen, new species

(Figs. 1–6, 12, 14)

Specimens examined.—Holotype ♂: ARKANSAS, Montgomery County, first-order tributary of Caddo River, Caddo Gap, N34.389° W93.626°, 28 May 1990, K. J. Tennessen; allotype ♀: same locality as ho-



Figs 1–5. *Cordulegaster talaria* color pattern and appendages. 1, Pterothorax, dorsal view. 2, Pterothorax, lateral view. 3, Abdominal segments 5–10, dorsal view. 4, Cerci and epiproct, lateral view. 5, Cerci and epiproct, dorsal view.

lotype, 26 May 1990; both deposited in Florida State Collection of Arthropods, Gainesville, Florida (FSCA). Paratypes (15 ♂, 4 ♀): ARKANSAS, Montgomery County, same locality, 28 May 1990, 2 ♂, K. J. Tennessen (FSCA); 3 ♂, J. J. Daigle (JJD, Tallahassee, Florida); 1 ♀, 29 May 1990, J. J. Daigle (JJD); 17 May 1992, 4 ♂, 2 ♀, K. J. Tennessen (1♂ 1♀ in National Museum of Natural History, Smithsonian Institution, 3♂ 1♀ in FSCA); 23 May 1992, 2 ♂, T. E. Vogt (TEV, Hillsboro, Illinois);

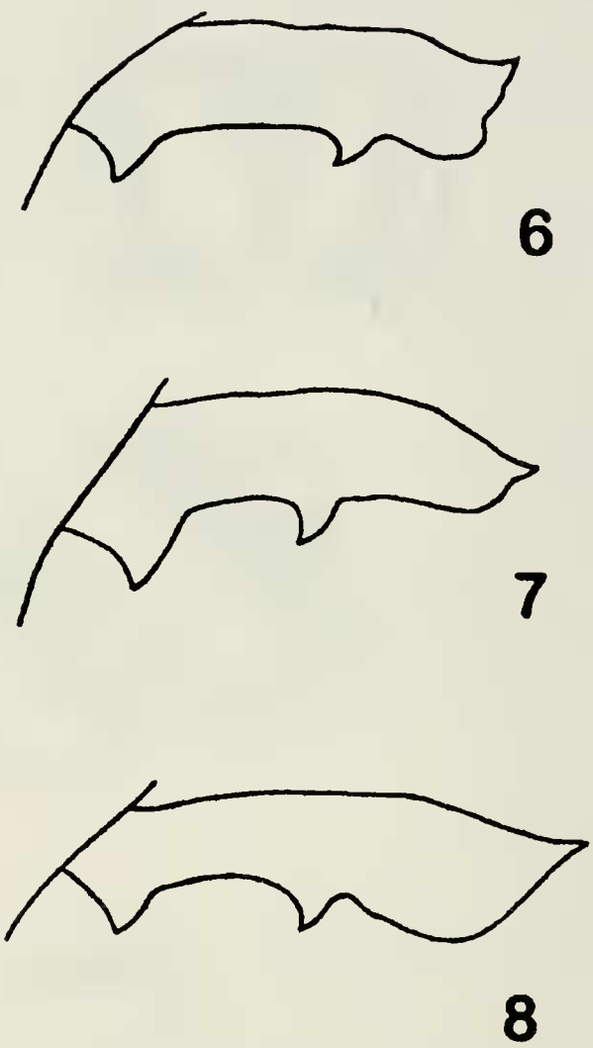
26 May 1993, 4 ♂, 1 ♀, K. J. Tennessen (FSCA). Additional record: ARKANSAS, Garland County, road along Red Branch, off Hwy. 70 near access to Charlton campground, N34.555° W93.388°, 24 May 1990, 1 ♀, K. J. Tennessen.

Etymology.—From *talaria* (Latin) liberally translated meaning "wings about the ankles," referring to the habit of males flying low over the shallow water of small seeps in search of females.

Holotype.—*Head:* Eyes green in life. Labium, maxilla, base of mandible tan white; apical half of mandible dark brown, teeth black; labrum bone white, anterior margin brown; anteclypeus mostly black brown except green tan laterally; postclypeus bone white with slight yellow green cast, except lower margin black brown; antefrons same color as postclypeus; antenna and vertex dark brown to black; occiput bone white, crest black with thick fringe of long black setae; postocular border with black stripe 0.2 mm wide; rear of head off-white. Gap between compound eyes 0.28 mm.

Thorax: Prothorax brown; ground color of pterothorax dark brown; dorsal carina black; yellow, tear-drop shaped dorsal stripe on each side of dorsal carina (Fig. 1) with slight bluish cast, maximum width (1.35 mm at upper end) 0.4 its length; anterior ends of these stripes 0.5 mm from collar; mesinfraepisternum brown with elongate black spot in center and dull yellow spot ventrally; two lateral yellow stripes, maximum width of mesepimeral stripe less than maximum width of metepimeral stripe (1.23 mm vs. 1.48 mm; Fig. 2). Wing veins black to brown, except anterior edge of costa yellow; pterostigma dark brown.

Abdomen: Ground color black to black brown with conspicuous yellow markings as follows: segments (AbS) 2 and 3 with dorsolateral stripes full length of segment; AbS 4 with anterior dorsolateral rectangular markings each followed by an elongate triangle; AbS 5 and 6 with small circle anterior to shorter, almost trapezoidal, triangle;



Figs. 6–8. Left male cercus, ventrolateral view. 6, *Cordulegaster talaria.* 7, *C. diastatops.* 8, *C. bilineata.*

AbS 7 with larger circular spot anterior to larger triangle; AbS 8 with roughly triangular dorsolateral spots not as acute at tips as triangles on preceding segments; AbS 9 with very small, anterolateral yellow spots; AbS 10 black dorsally (Fig. 3). Cercus dark brown, 1.61 mm long, with two ventral teeth and an apical, ventromesally directed flat lobe (Fig. 4); epiproct light brown dorsally, tips black dorsally with 2 small black teeth, apical margin slightly sinuate (Fig. 5), 1.87 mm wide (maximum width at tips, measured in ventral view). Ratio of epiproct width to cercus length 1.16.

Measurements (mm): Total length 62, abdomen length 47, hind wing length 39.5, pterostigma (h.w.) 3.94, hind femur length 6.5.

Allotype.—*Head:* Similar to holotype, except labrum pale yellow, postclypeus and antefrons off-yellow with greenish cast lat-

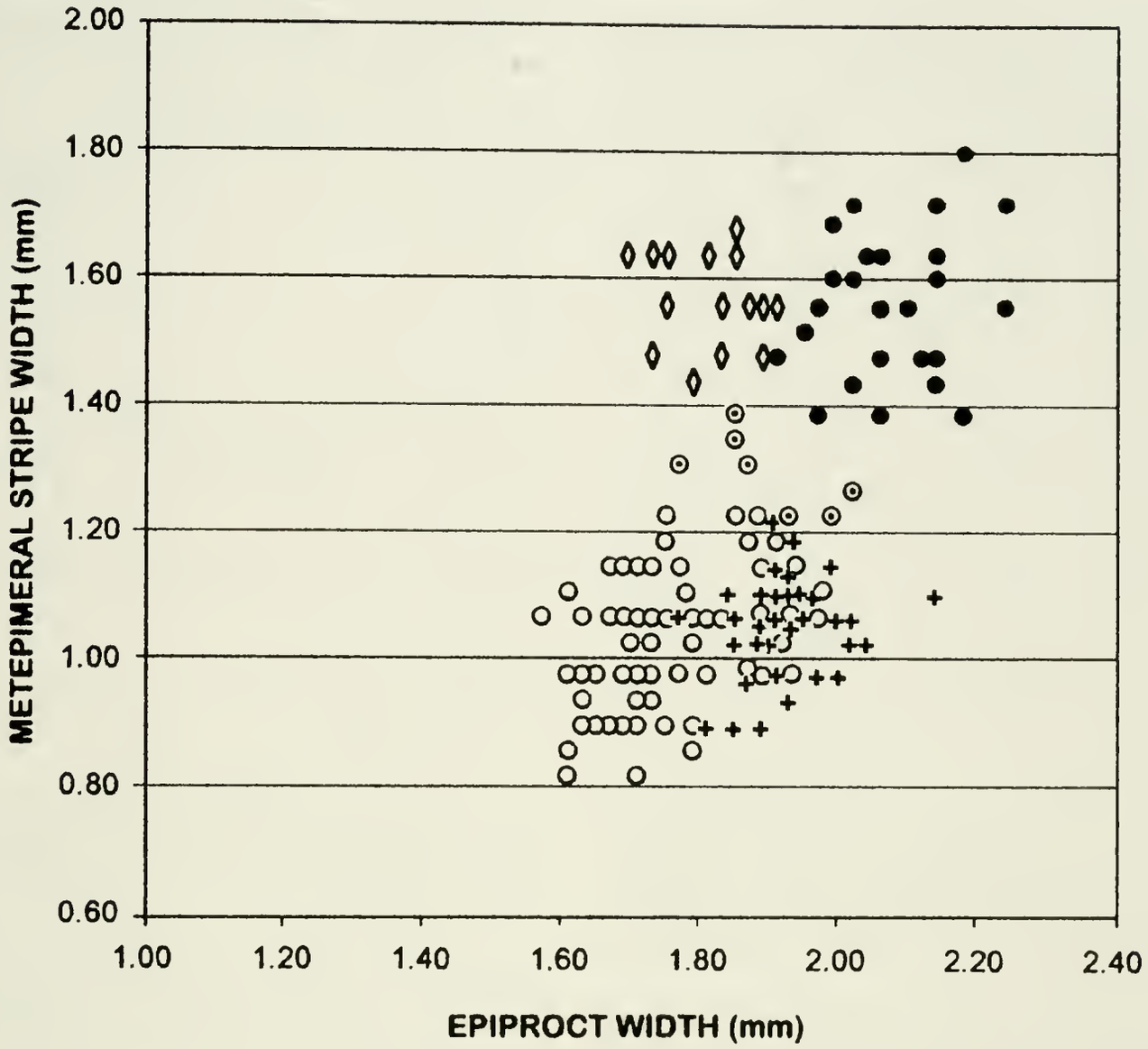


Fig. 9. *Cordulegaster diastatops* group, male epiproct width (mm) vs. metepimeral yellow stripe width (mm). Open circle (○) = *C. bilineata,* solid circle (●) = *C. diastatops,* plus sign (+) = *C. sayi,* open diamond (◊) = *C. talaria,* half-filled circle (⊙) = intermediate between *bilineata* and *diastatops.*

erally. Gap between compound eyes 0.48 mm. *Thorax:* Similar in color pattern to holotype; metepimeral yellow stripe 1.64 mm wide. *Abdomen:* Color pattern similar to holotype male, except yellow triangle on AbS 8 abbreviated and AbS 9 without yellow markings. Cercus length 0.91 mm. Tip of ovipositor extends about 1.1 mm beyond posterior margin of paraprocts. *Measurements* (mm): Total length 67, abdomen length 51, hind wing length 42, pterostigma (h.w.) 4.18, hind femur length 7.0, ovipositor 4.0.

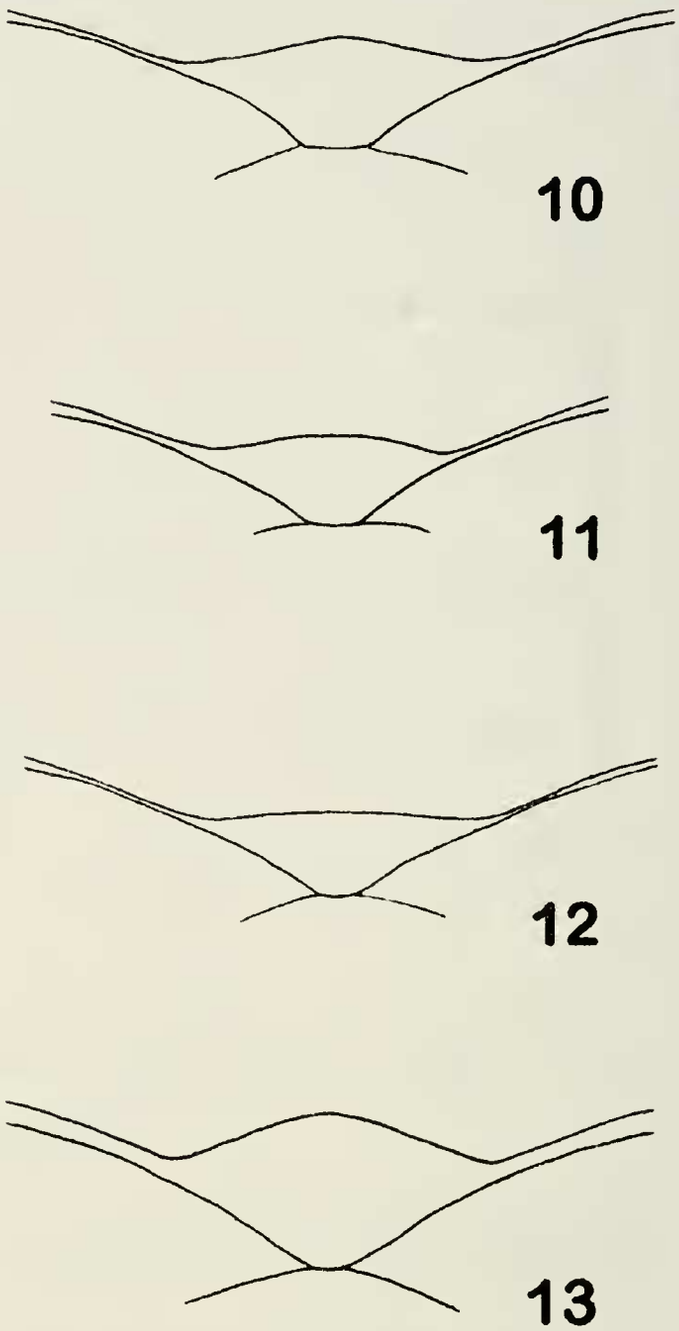
I have collected and reared larvae of *C. talaria,* the description of which will appear in a future paper.

Variation in paratypes.—Two paratype males and one female have definite yellow markings on the metepisternum between the large lateral yellow stripes and above the second thoracic spiracle. Maximum width of metepimeral yellow stripes ranged from 1.44–1.68 mm in the male and 1.64–1.80 mm in the female. In 3 males, the anterolateral elongate yellow markings on AbS 4 were narrower than in the holotype and did not reach the anterior margin of the segment. The anterolateral spots on AbS 5 were more elongate than in the holotype in 3 males and were reduced or wanting on AbS 6 in 4 males; the spots on AbS 5–7 in the female varied in length from shorter to longer than in the allotype. The midlateral yellow spots on AbS 8 were usually sepa-

rated as in the holotype, but were contiguous middorsally in 2 males. Cercus length ranged from 1.55 to 1.73 mm in the male, 0.95 to 1.09 mm in the female. The apical third of the male cerci varied slightly in ventrolateral view, from not as lobate to slightly more lobate than the holotype. The ratio of maximum distal epiproct width to cercus length (measured dorsally) ranged from 1.28 to 1.42 (mean 1.36). The ovipositor length ranged from 3.70 to 3.95 mm in the paratypes vs. 4.00 mm in the allotype. Antenodal crossveins in f.w. of male varied from 15–21, in h.w. 12–16; postnodals 10–18 in f.w., 11–17 in h.w. Antenodal crossveins in f.w. of female varied from 17–22, in h.w. 13–16; postnodals 13–18 in f.w., 15–18 in h.w.

Range in measurements (mm): Male, total length 59.0–65.0, abdomen length 44.0–50.0, hind wing length 37.0–39.5, pterostigma length (h.w.) 3.53–4.02, epiproct width 1.69–1.91. Female, total length 64.5–67.0, abdomen length 49.0–52.0, hind wing length 42.0–43.0, pterostigma length (h.w.) 3.77–4.18.

Diagnosis.—The distance, or gap, between the tips of the ventral cercal teeth of *C. talaria* males will separate them from the other three species in the *diastatops* group; this gap is greatest in *C. talaria* and does not overlap that of any of the other species (Table 1). I found no significant difference between *C. bilineata* and *C. diastatops*, whereas *C. sayi* had the smallest gap (Table 2). These species are usually distinguishable also by cercus shape. In ventrolateral view, the cercus is of uniform width with a definite lobate apex in *C. talaria* (Fig. 6), wider basally than apically and with a more tapered apex in *C. diastatops* (Fig. 7), and narrower basally than apically and with a widened, enlarged angle in *C. bilineata* (Fig. 8). Cercus shape is quite variable, however, especially in *C. bilineata* and *C. diastatops*, and these differences may not always be reliable. In epiproct distal width, *C. talaria* was significantly narrower than *C. diastatops* but was not different from *C. bilineata*. On the other hand, metepimeral yellow stripe width was significantly greater in *C. talaria* than in *C. bilineata* but not different from *C. diastatops* (Tables 1 and 2).



Figs. 10–13. Female occipital crest, anterior view. 10, *Cordulegaster diastatops*. 11, *C. bilineata*. 12, *C. talaria*. 13, *C. sayi*.

Pilgrim et al. (2002) found a significant difference between *C. bilineata* and *C. diastatops* in the ratio of epiproct distal width to cercus length. Calculating this ratio for specimens available to me, I obtained significant differences between *C. talaria* and the other three species (Table 2); the only species pair not yielding a signif-

Table 1. Summary of four morphological characters for the *Cordulegaster diastatops* group; measurements for characters 1, 2 and 4 in mm.

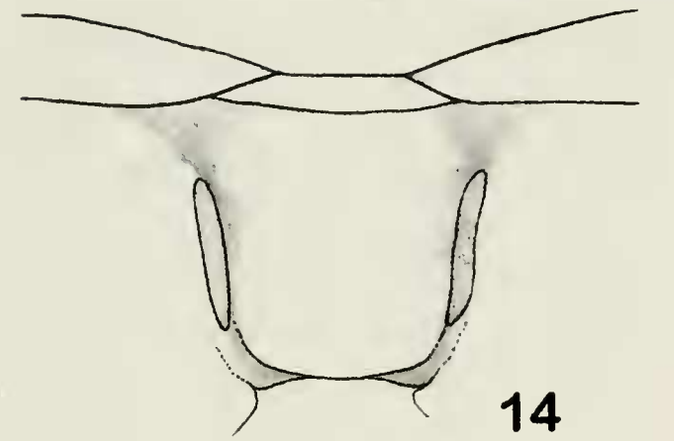
Character	Species	n	Mean	Range	95% C.I.
1) Cercus Teeth Gap	*C. bilineata*	77	0.64	0.52–0.73	±0.01
	C. diastatops	32	0.65	0.54–0.71	±0.01
	C. sayi	40	0.46	0.36–0.52	±0.01
	C. talaria	19	0.83	0.77–0.89	±0.01
2) Epiproct Width	*C. bilineata*	77	1.76	1.57–1.99	±0.02
	C. diastatops	32	2.05	1.77–2.24	±0.04
	C. sayi	40	1.93	1.77–2.14	±0.02
	C. talaria	19	1.81	1.69–1.91	±0.03
3) Epiproct Width/Cercus Length	*C. bilineata*	75	0.99	0.87–1.16	±0.03
	C. diastatops	32	1.23	1.12–1.40	±0.03
	C. sayi	40	0.98	0.89–1.11	±0.02
	C. talaria	19	1.10	1.02–1.16	±0.02
4) Metepimeral Stripe Width	*C. bilineata*	77	1.06	0.82–1.31	±0.03
	C. diastatops	32	1.52	1.27–1.80	±0.05
	C. sayi	40	1.05	0.90–1.23	±0.02
	C. talaria	19	1.59	1.44–1.68	±0.03

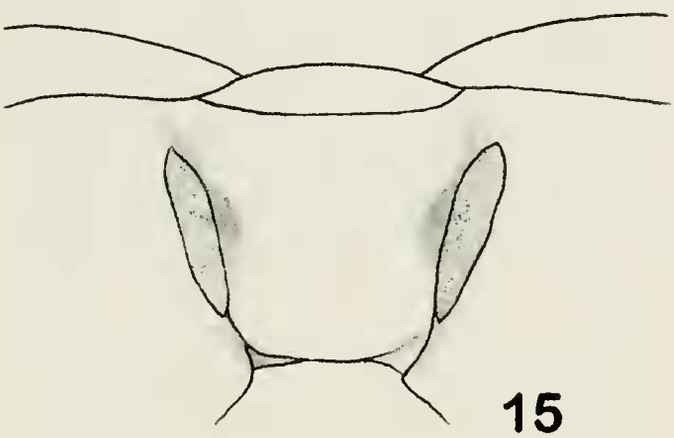
icant difference was *C. bilineata/sayi*. Another combination of characters by which to distinguish *C. talaria* is epiproct distal width plotted against metepimeral yellow stripe width (Fig. 9). The *C. talaria* cluster is close to that of *C. diastatops*, whereas the *C. bilineata* cluster overlaps the *C. sayi* cluster to a large degree. Several specimens from WV, OH, and MI (indicated by a half-filled circle on the graph) are difficult to assign to either the *C. bilineata* or *C. diastatops* cluster; these are dealt with further in the Discussion.

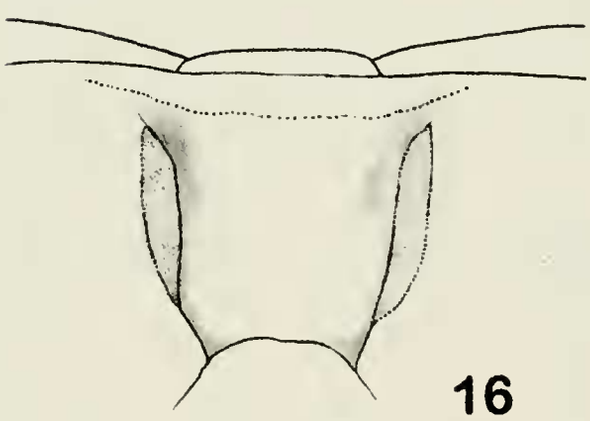
In male color pattern, *C. talaria* is most similar to *C. diastatops*. The ground color is very dark brown to black and brown, although not quite as black as in most *C. diastatops*. The yellow stripes and spots are a darker hue than the pale yellow markings of *C. bilineata*. On AbS 2, the dorsolateral yellow bands have a definite dorsomedially-directed dark yellow offshoot in *C. talaria* that is absent or obscured in *C. bilineata* and *C. diastatops*. On AbS 4, the anterolateral yellow marking is elongate and usually extends to the anterior margin of the segment in *C. talaria*. This mark is variable in *C. diastatops* but usually does not reach the anterior margin; in *C. bilineata* it is very abbreviated and triangular.

Female *C. talaria* differ from female *C. bilineata* in having wider metepimeral stripes (1.64–1.80 mm vs. 1.15–1.31 mm) and an elongate anterolateral yellow spot on AbS 4 (often 4–7) vs. a small rounded spot in *C. bilineata*. I did not find a consistent color pattern difference between females of *C. talaria* and *C. diastatops*. Although the ground color of *C. diastatops* females throughout most of its range is much darker than that of *C. talaria*, several *C. diastatops* from MI are not totally black but are rather similar in color to *C. talaria*. The crest of the occiput, in direct anterior view, is distinctly convex in *C. diastatops* (Fig. 10), slightly to distinctly convex in *C. bilineata* (Fig. 11), and straight to very slightly convex in *C. talaria* (Fig. 12); in *C. sayi* it is even more convex than in *C. diastatops* (Fig. 13).

I found another difference on the posterior surface of the occiput. In the dark groove along each side of the convex yellow medial surface there is an elongate, gray, rugulose "pad" that is short and narrow (0.84–0.88 mm × 0.14–0.16 mm) in







Figs. 14–16. Female occiput, posterior view. 14, *Cordulegaster talaria*. 15, *C. diastatops*. 16, *C. bilineata*.

C. talaria (Fig. 14) versus longer and wider (1.00–1.04 mm × 0.22–0.26 mm) in *C. diastatops* (Fig. 15). Also, the pads diverge at a greater angle in *C. diastatops*. In *C. bilineata*, the pads are 0.90–0.94 mm long × 0.20–0.22 mm wide and are only slightly divergent dorsally (Fig. 16). To my knowledge, a description of these "postoccipital pads" has not appeared previously in the literature and their usefulness as taxonomic characters is unknown. They vary interspecifically in other *Cordulegaster* species, being black and nearly circular in *C. erronea* Hagen, tan and oval with pits near the center in *C. obliqua* (Say), and vestigial or absent in *C. maculata* Selys and *C. dorsalis* Hagen. It is possible that they are contacted by the ventral edge of the male cerci during tandem formation and that they act as sensory structures, although they also occur on the male occiput.

Discussion

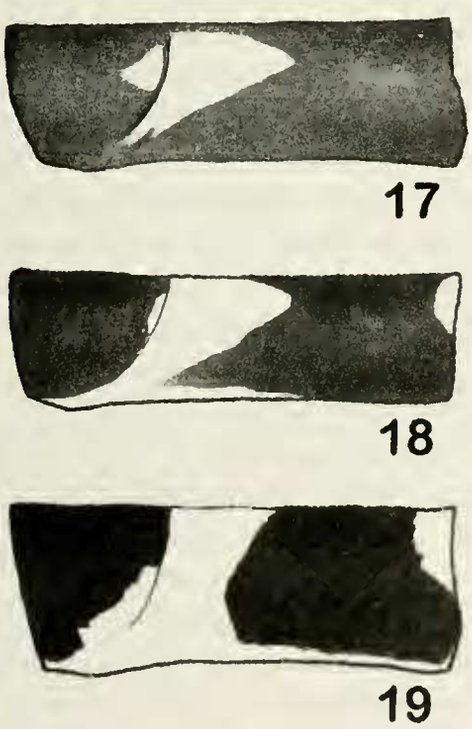
Taxonomy of the seven North American species of Cordulegastridae described prior to 1880 has been stable, whereas the validity of several recently described taxa is uncertain. For example, Needham et al. (2000) considered *C. deserticola* Cruden (1969) as a "questionably distinct subspecies" of *C. dorsalis* Hagen. More study is needed to determine its status. Glotzhober (1997) pointed out doubt among taxonomists concerning the validity of *C. bilineata* based on the presence of intermediate specimens from several central states. Pilgrim et al. (2002) combined external morphology and DNA sequencing and determined that *C. bilineata* is distinct from *C. diastatops*. Although they found one specimen from WI that appeared to be a hybrid based on genetic data, they concluded that this was not sufficient evidence to synonymize the two taxa. Eric Pilgrim (personal communication) prepared internal transcribed spacer 1 (ITS-1) sequences of rDNA from two paratype males of *C. talaria* and without seeing morphological data concluded it is likely a distinct species from *C. bilineata* and *C. diastatops*. His genetic data indicate that the number of differences between the four species in the *diastatops* group is small, and that *C. talaria* is likely the sister species of *C. bilineata* whereas *C. diastatops* is likely the sister species of *C. sayi*.

As mentioned in the Diagnosis section, some specimens in the middle of the geo-

Table 2. *P* values for characters in Table 1 Scheffe Test; asterisk denotes significance at $P = 0.05$.

Species Comparison/Character	1	2	3	4
bilineata, diastatops	0.39	<0.01*	<0.01*	<0.01*
bilineata, sayi	<0.01*	<0.01*	0.99	0.79
bilineata, talaria	<0.01*	<0.01*	<0.01*	<0.001*
diastatops, sayi	<0.01*	<0.01*	<0.01*	<0.001*
diastatops, talaria	<0.01*	<0.01*	<0.01*	<0.28
sayi, talaria	<0.01*	<0.01*	<0.01*	<0.01*

graphic range of *C. bilineata* and *C. diastatops* are difficult to determine. I examined several specimens from WV to WI that have intermediate character states (Fig. 9). In a key to species, Carle (1983) gave but one morphological character to distinguish the two species: epiproct width (maximum width measured near distal end) nearly equal to cercus length in *C. bilineata* vs. epiproct width about 1.3 times as long as cercus length in *C. diastatops*. He did not quantify variation in epiproct width for either species. Pilgrim et al. (2002) found considerable variation in epiproct width of the two species, but nearly all *C. bilineata* had an epiproct width to cercus length ratio (EDW/CL) less than 1.35 whereas the ratio was greater than this critical value in nearly all *C. diastatops*. I measured cercus length laterally and obtained greater values than Pilgrim et al. (2002) who measured cercus length dorsally; therefore I obtained correspondingly smaller EDW/CL ratios. For specimens I identified positively as *C. bilineata* (i.e., light brown ground color and metepimeral stripe 0.82–1.23 mm wide, from AL, GA, IL, IN, KY, LA, NC, TN and VA), epiproct width varied from 1.57 to 1.97 mm and EDW/CL ratio from 0.87–1.16. In specimens I identified positively as *C. diastatops* (i.e., black ground color and metepimeral stripe 1.39–1.80 mm wide, from ME, MA, NH, NJ, NY, PA, VT, WV and Ontario), epiproct width varied from 1.99 to 2.24 mm and EDW/CL ratio varied from 1.12–1.40. Specimens from OH and MI with intermediate body color (very dark brown) and metepimeral stripe widths at the upper end of the *C. bilineata* range and lower end of the *diastatops* range had intermediate EDW/CL ratios (0.97–1.23). It is possible that at least some of these are hybrid individuals; further study with larger sample sizes is indicated. If *C. bilineata* and *C. diastatops* are valid species, it appears that intermediates and possibly hybrids occur from east to west where their ranges overlap.



Figs. 17–19. Male abdominal segment 4, lateral view. 17, *Cordulegaster bilineata* (GA, Murray Co.). 18, *C. bilineata/sayi* intermediate (AL, Escambia Co.). 19, *C. sayi* (FL, Santa Rosa Co.).

Hybridization in the *C. diastatops* group might not be limited to *C. bilineata* and *C. diastatops*. I examined two specimens from extreme southern Alabama that are intermediate between *C. bilineata* and *C. sayi*. A male collected by R. S. Krotzer (RSK)

in Escambia County, seepage headwaters of Little Creek, ca. 40 km SW of Andalusia (N31.018° W86.842°), 22 Apr 1993, has the light brown ground color of *C. bilineata* and lacks magenta in the thoracic stripes. However, the distance between the ventral teeth of the cerci is only 0.52 mm (equal to the minimum I measured in *C. bilineata* and maximum in *C. sayi*). AbS 3–5 have yellow medial spots nearly contiguous middorsally and extended ventrolaterally to the yellow ventral margin of the tergites (Fig. 18); this color pattern is more extensive than in *C. bilineata* (Fig. 17) but more constricted than in *C. sayi* (Fig. 19) On AbS 4, there is a lateroapical yellow spot (Fig. 18) which is smaller than in *C. sayi* (Fig. 19); this spot is usually lacking in *C. bilineata* (Fig. 17) although a few specimens I examined had a faint indication of it. If this male is a hybrid, it appears to be more like *C. bilineata* than *sayi*. A female collected by RSK at the same locality (19 Mar 1994) has faint magenta coloration at the edges of the lateral yellow thoracic stripes and wide, nearly complete, medial yellow rings on AbS 3–6 (middorsal carina light brown) and complete apical yellow rings on AbS 3–5. This combination of markings is less developed than in *C. sayi* yet much more developed than in *C. bilineata*, which has the medial yellow spots on AbS 3–6 roughly triangular and distinctly separated middorsally, and the lateroapical spots on AbS 3 small and widely separated (these spots are usually absent on AbS 4–6). Therefore, if this female is a hybrid, it appears to be more like *C. sayi* than *C. bilineata* (*C. sayi* has not been recorded in Alabama previously, although a population occurs in Santa Rosa County, Florida, approximately 15 km south of Little Creek where RSK collected the possible hybrids). The two specimens collected in southern Alabama indicate further hybridization in this closely related species complex, but I doubt anyone would suggest synonymizing *C. bilineata* and *C. sayi*. If these species occasionally interbreed, it casts further doubt that *Archegaster* (Lohmann 1992) is a valid genus.

The first-order tributary where most of the *C. talaria* specimens were collected originates at the base of a wooded hill approximately 150 m from the Caddo River. The head of the seep branches from a densely shaded area, forming a small stream about 25–40 cm wide which runs through open pasture for most of its length before entering the wooded bank of the river. The dominant aquatic macrophyte in the open part of the stream was water starwort (*Callitriche heterophylla*). The shady seep comprises a small area, approximately 50 m^2, and is only 2.5–10 cm deep, with a substrate of organic ooze, mud, and dead sticks partly covered with moss. The future integrity of the seep is questionable. Cattle graze the pasture along the first-order stream and adjacent to the seep, although they apparently do not enter the actual seep probably because of the density of brush. If the brush were cleared from the seep, the habitat may become unsuitable for *Cordulegaster*. On two occasions, I saw deep tire tracks from an off-road vehicle in the mud at the edge of the seep.

Males of *C. talaria* perched on sticks along the open part of the tributary, occasionally flying upstream into the shaded seep, usually within 7.5–20 cm of the water surface. Their flight appeared very purposeful, often interrupted by short hovering bouts, then continuing for a meter or more. The latest I saw males active was about 1800h CDT. I observed females oviposit in mid- to late-afternoon, but only in the shaded seepage area. They were unobtrusive, dipping straight down (with head directed upward in rather typical *Cordulegaster* fashion) about once a second to "stab" eggs in mud and moss, both in shallow water and above the waterline. One female made these oviposition movements into moss growing on a woody root about 8 cm above the water.

The dragonfly fauna of the Ozark Plateau in the south-central United States contains

several endemic species, viz. *Somatochlora ozarkensis* Bird, *Gomphus ozarkensis* Westfall, and *Ophiogomphus westfalli* Cook & Daigle. It is very probable that *Cordulegaster talaria* is also endemic to this region. Two species of Cordulegastridae have been recorded previously for Arkansas, *Cordulegaster maculata* Selys and *C. obliqua* (Say) (Harp and Rickett 1977, 1985). I found larvae of one other species of Odonata in the seep, namely *Libellula flavida* Rambur. Several *Cordulegaster obliqua* females were seen in the pasture along the Caddo River, and one male was collected at the seep. Although I found larvae of *C. talaria* in the seep, I did not find larvae of *C. obliqua* there. Other Anisoptera present in the openings and pastures surrounding the seep were *Tachopteryx thoreyi* (Hagen), *Gomphus graslinellus* Walsh, *Gomphus ozarkensis, Ophiogomphus westfalli, Didymops transversa* (Say), *Macromia pacifica* Hagen, *Epitheca costalis* (Selys), *Epitheca cynosura* (Say), *Neurocordulia xanthosoma* (Williamson), *Libellula semifasciata* Burmeister and *Plathemis lydia* Drury. Although I did not find larvae of *T. thoreyi* in the seep, adults were active nearby and larvae probably occur at the edges of the seep. Two Zygoptera, *Hetaerina americana* (Fabricius) and *Enallagma divagans* Selys, were seen in vicinity of the seep. The majority of the other species do not inhabit the seep but rather the Caddo River or nearby ditches and wetlands.

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